low. But the busy man and the man without mathematical training must take the statements of the next 8 chapters, or 146 pages, on faith. The essential equations in the greatest abundance are there and their meanings explained, but checking them all up would be no easy task.

The general conclusions all this mathematical work leads to are given in a short chapter of only 6 pages, and in another place 20 separate theses are proposed that should set many young men at work on problems that are both new and useful in applied mathematics.

But, the "practical" man will say, what's the use of all this theory and all these mathematical equations? The answer in this case as in all similar cases is: To tell the practical man what to practise, what experiments are needed and what are not, what general type of machine is likely to succeed and what is certain to fail; to save him from needless blundering and to assure him of results and how to obtain them that he never did and never would even dream of.

Professor Bryan's book is especially adapted to the needs of advanced students in physics, applied mathematics and certain branches of engineering, and richly deserves a place in both mathematical and physical libraries.

W. J. Humphreys

Non-Marine Mollusca of Patagonia. By Henry A. Pilsbry. Reports Princeton University Expeditions to Patagonia, Vol. III., Part V.

This important work was issued in 1911, but there is nothing about the separate issue to indicate the date. It deals with the non-marine molluscs of Tierra del Fuego and Patagonia as far north as the thirty-ninth parallel, and is most beautifully illustrated by colored and uncolored plates. Of certain families, all the South American forms are listed. At the end is given a most interesting discussion of the characteristics and origin of the South American Mollusca.

The poverty of the Patagonian fauna in land snails is remarkable. Seven Endodontidæ and the two Zonitidæ have been described, all small. Their precise affinities are uncertain, from lack of knowledge of the internal anatomy. A small slug has been reported, perhaps introduced. *Succinea* is represented by several species, one of them abundant. No doubt other species will be discovered, but certainly no other part of the world, in a similar latitude, has such a meager representation of land shells. With the fresh-water snails it is somewhat different, the fauna not only containing a number of species of the families familiar in the northern hemisphere, but also a rich representation of the Chilinidæ, a family confined to the temperate and cold zones of South America. All the Chilinids east of the Andes are discussed, with four fine plates. Six colored plates are devoted to the Amnicolid genus *Potamolithus,* of which a complete revision is given. There is a complete list of the South American Sphœriidæ, with descriptions of several species. Thus the work, while ostensibly a report on the Princeton collections, is in reality much more extensive and important than the title would suggest.

All zoologists will be interested in the general discussion of the fauna. Dr. Pilsbry recognizes a Cœnogæic or northern group of families, and an Eogæic or southern group, the latter having "occupied chiefly the Gondwana continent, including a large part of South America, tropical and South Africa, and stretching in a great arch, possibly at no time perfect, to peninsular India and Australia." It is in this second group that he would place the Mutelidæ, Ampullariidæ, Acavidæ, Bulimulidæ, Achatinidæ, Streptaxidæ, etc. With regard to Antarctica, it is shown that the non-marine molluscs, taken by themselves, indicate that: (1) "There is no evidence that Antarctica was ever an evolution or radiation center for non-marine mollusks, though there is some evidence showing that it served as a highway for migration." (2) "There is some evidence of migration from South America to Australia, but at present no evidence of a counter movement to South America." (3) "Nothing in the dis-

tribution of mollusks would lead to the hypothesis that South Africa has ever been connected with Antarctica and thereby indirectly with southern South America." It is finally concluded that "the South American molluscan fauna is traceable to two sources: an ancient southern continent lying across the south Atlantic and enduring from at least Palæozoic to near the end of Cretaceous time, and to Miocene and Pliocene to recent connections with the middle American area." Since the appearance of Dr. Pilsbry's work, Dr. Ortmann has published the anatomy of the Australian fresh-water mussel *Hyridella,* showing that it is indeed allied to the South American *Diplodon,* further suggesting communication between these areas. All these matters no doubt deserve fuller discussion. According to Dr. Schuchert's recent map, North America was rather broadly continuous with South in the late Comanchic period, and remained so during the Cretaceous. During the early and middle Tertiary this connection was interrupted; but with the coming of the Pliocene, according to Dr. H. F. Osborn, it was renewed, and has continued to the present day. There should be, therefore, two elements in the neotropical fauna, both derived from the north, one of Mesozoic age, the other late Tertiary. The latter is recognized by Dr. Pilsbry, but where is the former? Is it not, at least in part, the "Eogæic" group of families? Is there anything in the Molluscan fauna which really supports the idea of a gigantic Gondwana continent, or any other body of land crossing the Atlantic or Pacific? It is true that molluscs are likely to travel slowly, the pace of the snail is proverbial; but they are ancient and have had time enough. *Cochlicopa lubrica,* assuredly a member of a Palæarctic group, has contrived to crawl all the way from the old world to New Mexico within the lifetime of its specific type, the animal being quite the same in Europe as in America. There is surely nothing in the distribution of snails which might not be explained by migrations from the north, and as to the negative evidence based on northern palæontology, it is clearly not worth much. As Dr. Pilsbry truly says, "the rarity of land and fresh-water shells as fossils, and the great antiquity of the family groups, renders the question very intricate." On the other side, there is the fact that the Chilinidæ, certainly of no recent origin, have apparently never left South America. There are reasons for thinking that in Palæozoic times the Antarctic land mass supported a more or less luxuriant flora, with a corresponding fauna, which doubtless eventually spread in part to other regions of the earth.[1] It is even possible that the Chilinidæ came from this source; but we can hardly expect to find much, if any, clue to the components of this antarctic biota in the *present* distribution of life, for the simple reason that there has been abundant time for it to spread over the whole earth, wherever the conditions permitted.

With regard to the northern route from South America to Africa or Australia, or *vice versa,* it should be clearly understood that it is not necessary for a whole fauna to migrate, to account for such faunal resemblances as exist. Thus the Characinid fishes are to-day abundantly represented in the Ethiopian and Neotropical regions, but do not exist elsewhere except that one or two species enter the southwestern part of the nearctic. No fossil Characinids have been found in the north. The naïve conception of a transatlantic bridge on which the Characinids freely traveled appeals to the imagination, but it is found on examination that only one part of the African Characinid fauna is really at all close to the South American, while the latter has very important elements totally diverse from the African series. The indications are that the Characinids arose in the neotropical, and at some very remote period reached Africa, where they developed a type (Ichthyoborinæ + Distichodontinæ, probably to be regarded as a distinct family Distichodontidæ) entirely unique in some of its characters. At a much later time the Hydrocyonine Characinids appear to have arrived in Africa, the immigrants consisting perhaps of not more than one or two species, which during a relatively brief period overran the northern hemisphere, leav-

[1] See, for instance, Seward, *Quarterly Journal Geological Society,* August, 1897, pp. 335–338.

ing perhaps no fossil remains which will ever be detected.[2]

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SPECIAL ARTICLES

NOTE ON THE UPPER EOCENE TITANOTHEROID TELMATHERIUM (?) INCISIVUM DOUGLASS FROM THE UINTA BASIN

IN describing the type of this species (a skull, No. 2,398 Carnegie Museum Catalogue of Vertebrate Fossils) Mr. Douglass[1] said:

I think that this skull represents a different genus from *Telmatherium*, but I prefer to place it provisionally here rather than establish another genus.

Through the courtesy of Mr. Douglass, Director Holland and Professor Osborn, the present writer has been enabled to compare this type with the extensive Eocene Titanothere material in the American Museum of Natural History. With the approval of these gentlemen the species *Telmatherium (?) incisivum* Douglass is hereby made the type of a new genus or subgenus *Sthenodectes*.[2] This genus is distinguished from *Telmatherium ultimum* Osborn by the following assemblage of characters: (1) The incisors are far larger and more advanced in evolution, i^1 being closely appressed to its fellow in the median line, with anterior face elongate, anterointernal tip blunt, median basin large, posterior wall or cingulum very massive; i^2, i^3 extremely large with low recurved tips and very heavy posterior cingula. (2) The postcanine diastema is reduced or absent. (3) Superior premolars 2, 3, 4 are much more advanced than in *T. ultimum*, having very heavy internal cingula, pronounced external cingula, high slender internal cusps (deuterocones); p^2 especially is in a relatively advanced stage, as compared with *T. ultimum*. (4) The least transverse diameters of p^4 and of the anterior lobe of m^1, are greater, that of m^3 much less, than in *T. ultimum*. (5) The basicranial region differs in many details, such as the apparent junction of the post-glenoid and post-tympanic processes below the auditory meatus. (6) The occiput is low with a sharp, long, sagittal crest. (7) The forehead is relatively wide. (8) The nasals taper distally.

From *Manteoceras* (especially *M. uintensis*) the genus under consideration is distinguished by: (1) The form and size of the incisors and canines, (2) the much more advanced stage of evolution of the premolars, (3) the shorter anteroposterior diameter of m^2, (4) the reduction of the post-canine diastema, (5) the arched and spreading zygomata; etc.

From *Dolichorhinus* and *Mesatirhinus* it is separated by the shortness and relative breadth of the skull, the great size of the incisors, the relatively heavy zygomata and many other details.

The genus or subgenus *Sthenodectes* is apparently allied to *Metarhinus* and may well be related to *Metarhinus earlei* Osborn from the Upper Washakie, which it resembles in important characters of the premolars and molars, form of the basis cranii and occiput, marked constriction of the face in front of the orbits as seen from above. The narrow tapering nasals and other characters also suggest affinity with *Metarhinus diploconus*. The type skull of *Sthenodectes incisivum* differs from all known *Metarhinus* material in the form and in the very large size of the incisors and canines, in the much stronger internal cingula on the premolars, stout zygomata, junction of the post-glenoid and post-tympanic processes below the auditory meatus. The forms of the premaxillary and of the subnasal incisure also differ from those of *Metarhinus*. The supposed vacuities in the lachrymal region, although indicated on both sides, may be artifact.

WILLIAM K. GREGORY

[2] The Cichlidæ, with a very similar distribution, have left us beautifully preserved fossils of Eocene age in Wyoming, but not elsewhere.

[1] *Ann. Carnegie Mus.*, Vol. VI., No. 2, 1909, p. 305.

[2] $\sigma\theta\acute{\epsilon}\nu os$, strength, $\delta\eta\kappa\tau\acute{\eta}s$, a biter, in allusion to the great power and development of the incisors and canines.

OIL CONCENTRATION ABOUT SALT DOMES

IN several national, state and private publications the writer has called attention to the remarkable concretionary growth and bodily